

A REVISION OF THE PATAGONIAN PREDACEOUS MIDGE GENUS
BORKENTHELEA SPINELLI AND GROGAN
(DIPTERA: CERATOPOGONIDAE)

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Abstract.—A revision of the Patagonian predaceous midge genus *Borkenthelea* Spinelli and Grogan revealed three undescribed species that we describe and illustrate as **new species**: *Borkenthelea quatei*, from Argentina; *B. harii*, from Argentina and Chile; and *B. nerudai*, from Chile. A key is provided for the recognition of males and females of the four species in this genus.

Resumen.—La revisión del género *Borkenthelea* Spinelli y Grogan de la Patagonia, reveló la presencia de tres especies nuevas, las que son aquí descritas e ilustradas: *Borkenthelea quatei*, de la Argentina; *B. harii*, de la Argentina y Chile; y *B. nerudai*, de Chile. Además, se presenta una clave para el reconocimiento de machos y hembras de las cuatro especies de este género.

Key Words: Diptera, Ceratopogonidae, *Borkenthelea*, predaceous midges, new species, Patagonia

The predaceous midge genus *Borkenthelea* Spinelli and Grogan was proposed for the previously undescribed species *B. nothofagus* Spinelli and Grogan (1993). The type series of *B. nothofagus* included the holotype female and allotype male from Rio Negro Province, Argentina and two female paratypes from nearby Chile. A subsequent collecting trip to Patagonia by GRS and Larry Quate during 1994 yielded additional material that has allowed for a better understanding of the species composition of this apparently very rare genus.

In this article, we present changes to the generic diagnosis, describe and illustrate three undescribed species, and provide a

key for the recognition of males and females of all four species. For general terminology of Ceratopogonidae, see Downes and Wirth (1981); for terminology of predaceous midges in the tribe Ceratopogonini, see Wirth and Grogan (1988).

Our previous paper on this genus (Spinelli and Grogan 1993) contains a detailed generic diagnosis and comparison of this genus with other similar appearing genera. Recently acquired specimens were all mounted on microscope slides in the manner of Wirth and Marston (1968). Types are deposited in the Museo de La Plata, Argentina (MLPA) or the Canadian National Collection in Ottawa, Canada (CNCI), as indicated for each new species.

Borkenthelea Spinelli and Grogan

Borkenthelea Spinelli and Grogan, 1993: 321. Type-species, *Borkenthelea nothofagus* Spinelli and Grogan, by original designation.

Diagnosis.—The original generic diagnosis by Spinelli and Grogan (1993) is adequate for the recognition of all included species with the following emendations: Male antenna with flagellomeres 1–2 separated, 3–10 fused, 11–13 distinctly separated. Hind claws of female of similar diameter to claws of other legs or more massive. Costal ratio of female 0.54–0.63; of male 0.51–0.60. Male tergite 9 very short and triangular to moderately long and semiquadrate; apicolateral processes short and bulbous to elongated and slender. Aedeagus very short, or of moderate length. Parameres separate or fused basally.

Comments.—The condition of the male flagellum in which flagellomeres 3–10 are fused, apparently represents an apomorphic character state that is unique to the family (*A. Borkent*, personal communication) and is further evidence of the monophyly of this genus.

KEY TO SPECIES OF *BORKENTHELEA*

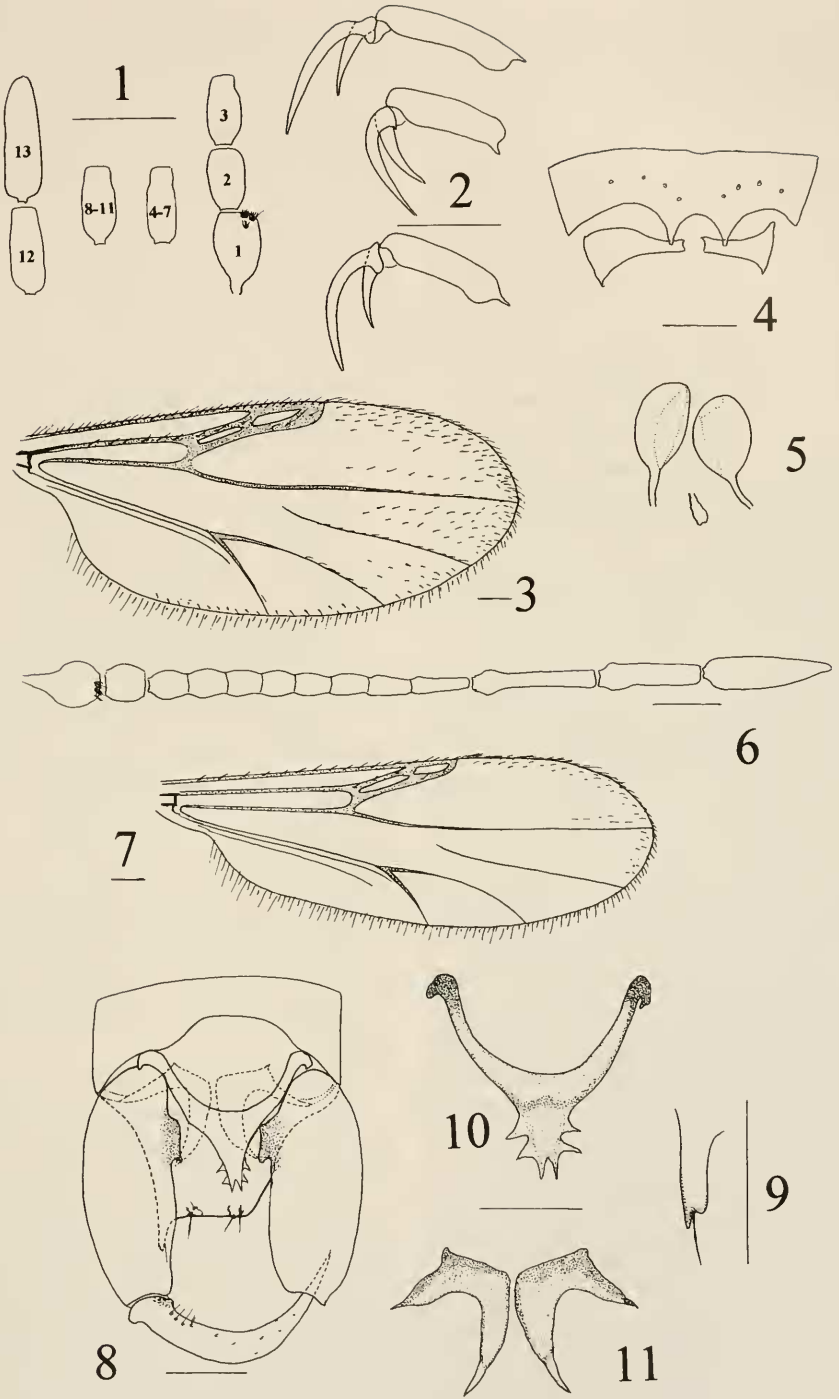
- 1. Female 2
- Male 5
- 2. Hind claw not massive (Fig. 2); halter brownish; sternite 9 represented by two reduced, slender plates (Fig. 4); spermathecae with very long necks (Fig. 5) *B. harii*, n. sp.
- Hind claw massive; halter pale; sternite 9 represented by two conspicuous plates; spermathecae with short necks 3
- 3. Cell *cua*₁ without macrotrichia (Fig. 12) *B. nerudai*, n. sp.
- Cell *cua*₁ with several macrotrichia 4
- 4. Large species (wing length 1.28–1.35 mm); mandible with 9–10 teeth; clypeus with 2–3 pairs of setae; antennal scape with 4 setae; antennal ratio 0.88–0.90; lumen of 2nd radial cell short, triangular *B. nothofagus* Spinelli and Grogan
- Smaller species (wing length 1.12 mm); mandible with 7 small teeth; clypeus with one pair of setae; antennal scape with 2 setae; antennal ratio 0.82; lumen of 2nd radial cell elongated (Fig. 19) *B. quatei*, n. sp.

- 5. Sternite 9 with one or more caudal excavations 6
- Sternite 9 without caudal excavations (Fig. 17) 7
- 6. Sternite 9 with a single shallow caudomedian excavation (Fig. 8); gonocoxite with a mesal truncated protuberance (Fig. 8); gonostylus distinctly shorter than gonocoxite; aedeagus with distal portion bearing 2 pairs of strong lateral teeth, tip bifid (Fig. 10) *B. harii*, n. sp.
- Sternite 9 with 3 deep caudal excavations, one medial and 2 lateral (Fig. 24); gonocoxite without mesal protuberance; gonostylus clearly longer than gonocoxite; distal portion of aedeagus without lateral teeth, tip pointed *B. quatei*, n. sp.
- 7. Gonocoxite with mesal protuberance directed caudomesally (Fig. 17); gonostylus deeply curved; parameres separated (Fig. 18); aedeagus with distal portion bearing 2 pointed sclerites that cross each other at their midlength (Fig. 17) *B. nerudai*, n. sp.
- Gonocoxite with mesal protuberance directed mesally; gonostylus slightly curved; parameres fused basally; aedeagus without pointed sclerites on distal portion *B. nothofagus* Spinelli and Grogan

Borkenthelea harii Spinelli and Grogan, new species (Figs. 1–11)

Diagnosis.—Distinguished from other species of *Borkenthelea* by the following combination of characters: female, hind claws non-massive, sternite 9 represented by 2 reduced slender plates, spermathecae with very long necks, and wing with subequal radial cells lacking macrotrichia in central portion of cell *cua*₁; male, tergite 9 broad caudally; sternite 9 with a single caudomedian excavation; gonocoxite with a mesal truncated protuberance; gonostylus shorter than gonocoxite; aedeagus with 2 pairs of pointed lateral teeth on distal portion, tip bifid; and parameres separate.

Female.—*Head*: Dark brown. Eyes pubescent, narrowly contiguous (V-shaped where contiguous). Antennal scape with 2 setae; flagellum (Fig. 1) brown; flagellomere 1 with 3–6 subapical sensilla coeloconica; lengths of flagellomeres (of allotype) in *um* 41-31-33-37-38-38-38-36-36-33-38-43-61; antennal ratio 0.78 (0.75–0.81, n = 2).



Figs. 1-11. *Borkenthelea harii*. 1, Flagellomeres of female flagellum. 2, 5th tarsomeres and claws of female, from top to bottom of fore, mid and hind legs. 3, Female wing. 4, Sternites 8 and 9 of female. 5, Spermathecae. 6, Male flagellum. 7, Male wing. 8, Male genitalia. 9, Detail of apicolateral process. 10, Aedeagus. 11, Parameres. Scales = 0.05 mm.

Clypeus with 2 pairs of setae. Palpus brown; lengths of segments (of allotype) in μm 15-28-28-18-28; segment 4 with 2-3 setae. Mandible with 8 teeth.

Thorax: Dark brown; 4 prealar setae, 1 postalar seta; scutellum with one medial and two lateral setae. Wing (Fig. 3) membrane infuscated, veins brown; macrotrichia present in cells r_5 , m_1 and m_2 , only marginally in cell cu_{a1} and anal cell; radial cells equal sized, well developed, 1st with narrow lumen (slightly broader in paratype), 2nd with broader lumen; radial veins not unusually thickened; media with long petiole, branching slightly distad to level of R_{2+3} , M_2 obsolete at extreme base; M_{3+4} and Cu_1 branching at level of midlength of 1st radial cell; wing length 1.00 ($n = 2$) mm, breadth 0.44 ($n = 2$) mm, costal ratio 0.62 (0.61-0.63, $n = 2$). Halter brownish. Legs brown; hind tibial comb with 7 setae; hind tarsal ratio 2.00 ($n = 2$); tarsomeres 5 (Fig. 2) slender with moderately large, unequal sized claws without basal teeth, those of hind leg not massive, claw length proportions of fore, mid, hind legs 12:7, 9:6, 10:6.

Abdomen: Dark brown, segments 7-9 more heavily sclerotized than others. Genitalia as in Fig. 4. Sternite 8 with pair of bluntly pointed posterior extensions. Sternite 9 represented by two reduced slender plates. Two ovoid spermathecae with long, slender necks plus rudimentary 3rd (Fig. 5), largest measuring 0.072 by 0.058 mm, neck 0.026 mm, and 0.062 by 0.046 mm, neck 0.026 mm.

Male.—Similar to female with the following notable sexual differences: flagellum (Fig. 6) with flagellomeres 1-2 separated, 3-10 fused, 11-13 distinctly separated with lengths (of holotype) in μm 92-77-94; wing (Fig. 7) length 1.03 (1.00-1.04, $n = 3$) mm, breadth 0.36 (0.35-0.37, $n = 3$) mm, costal ratio 0.60 ($n = 3$). Genitalia as in Figs. 8-11. Sternite 9 a third as long as greatest breadth with deep caudomedian excavation; tergite 9 with caudal margin nearly straight, apicolateral processes (Fig. 9)

with a single subapical seta, cercus short, with 2 apical setae. Gonocoxite stout, 2.7 times longer than greatest breadth, with stout, strongly sclerotized, truncated mesal protuberance; gonostylus slender with numerous small setae, clearly shorter than gonocoxite, distal half greatly curved and gradually tapering to slender, pointed tip. Aedeagus (Fig. 10) triangular, basal arch 0.5 of total length, distal portion with 2 pairs of strong lateral teeth, tip bifid. Parameres (Fig. 11) separated, nearly contiguous anteriorly; basal arms very stout basally; distal portions divergent with slender pointed tips.

Distribution.—Argentina (Andean forests of Chubut province); Chile (Llanquihue, Osorno).

Types.—Holotype δ , Argentina, Chubut, P. N. Los Alerces, 9/12-XII-1994, L. Quate, Malaise trap; Allotype f , Chile, Llanquihue, Las Cascadas, 13 km N. Ensenada, 1/2-XII-1994, L. Quate, Malaise trap. Paratypes, 3 δ , 1 f , Chile, Osorno, Puyehue, 6/8-XII-1994, L. Quate, Malaise trap (deposited in MLPA).

Etymology.—The specific name is a patronym in honor of Dr. Hari Bhat, of the National Institute of Virology, Pune, India, for his friendship during the 1994 trip to Patagonia with Dr. Larry Quate and GRS.

Discussion.—The females of the three other species in this genus differ from this new species in having massive hind claws, a pale halter, sternite 9 composed of two conspicuous plates, and spermathecae with short necks. Males of *B. nothofagus* and *B. nerudai* differ from this new species in lacking caudomedial excavations on sternite 9. Males of *B. quatei* differ from this new species in having sternite 9 with three deep caudomedian excavations, a gonocoxite with mesal protuberance, a gonostylus clearly longer than gonocoxite, and an aedeagus with a pointed tip that lacks lateral teeth on its distal portion.

***Borkenthelea nerudai* Spinelli and
Grogan, new species**
(Figs. 12–18)

Borkenthelea nothofagus Spinelli and Grogan 1993: 323, in part (female paratype from Cautin, Chile).

Diagnosis.—Distinguished from other species of *Borkenthelea* by the following combination of characters: female, with massive hind claws, sternite 9 halves broad, spermathecae with short necks, and a wing with subequal sized radial cells that lacks macrotrichia in cell cua_1 ; male, with tergite 9 tapering distally, sternite 9 without caudomedian excavation, gonocoxite with a slender pointed caudomesally directed protuberance, gonostylus shorter than gonocoxite, aedeagus with distal portion bearing 2 heavily sclerotized pointed sclerites that cross mesally, and parameres separate.

Allotype female.—*Head*: Dark brown. Eyes pubescent, narrowly contiguous (V-shaped where contiguous). Antennal scape with 5 setae; flagellum brown; flagellomere 1 with 3 subapical sensilla coeloconica; lengths of flagellomeres in μm 41-23-26-26-26-28-28-28-38-34-34-38-62; antennal ratio 0.92. Clypeus with 1 pair of setae. Palpus brown; lengths of segments in μm 15-20-38-23-36; segment 4 with 2 setae. Mandible with 10 teeth.

Thorax: Dark brown; 5 prealar setae, 1 postalar seta; scutellum with 2 medial, 2 lateral setae. Wing (Fig. 12) membrane infuscated, veins brown; macrotrichia sparse in cells r_5 , m_1 , m_2 , absent in cell cua_1 and anal cell; radial cells well developed, subequal sized, 1st with elongated narrow lumen, 2nd with broader triangular lumen, radial veins thickened especially distal of 2nd radial cell; media with long petiole, branching slightly distal to level of R_{2+3} , M_2 obsolete at extreme base; M_{3+4} and Cu_1 branching at level of midlength of 1st radial cell; wing length 1.00 mm, breadth 0.46 mm, costal ratio 0.54. Halter pale. Legs brown; hind tarsal ratio 2.00 ($n = 2$); hind tibial comb with 7 setae; tarsomeres 5 slender with

moderately large, unequal sized claws without basal teeth, those of hind leg most massive, claw length proportions of fore, mid, hind legs 9:7, 8:5, 6:4.

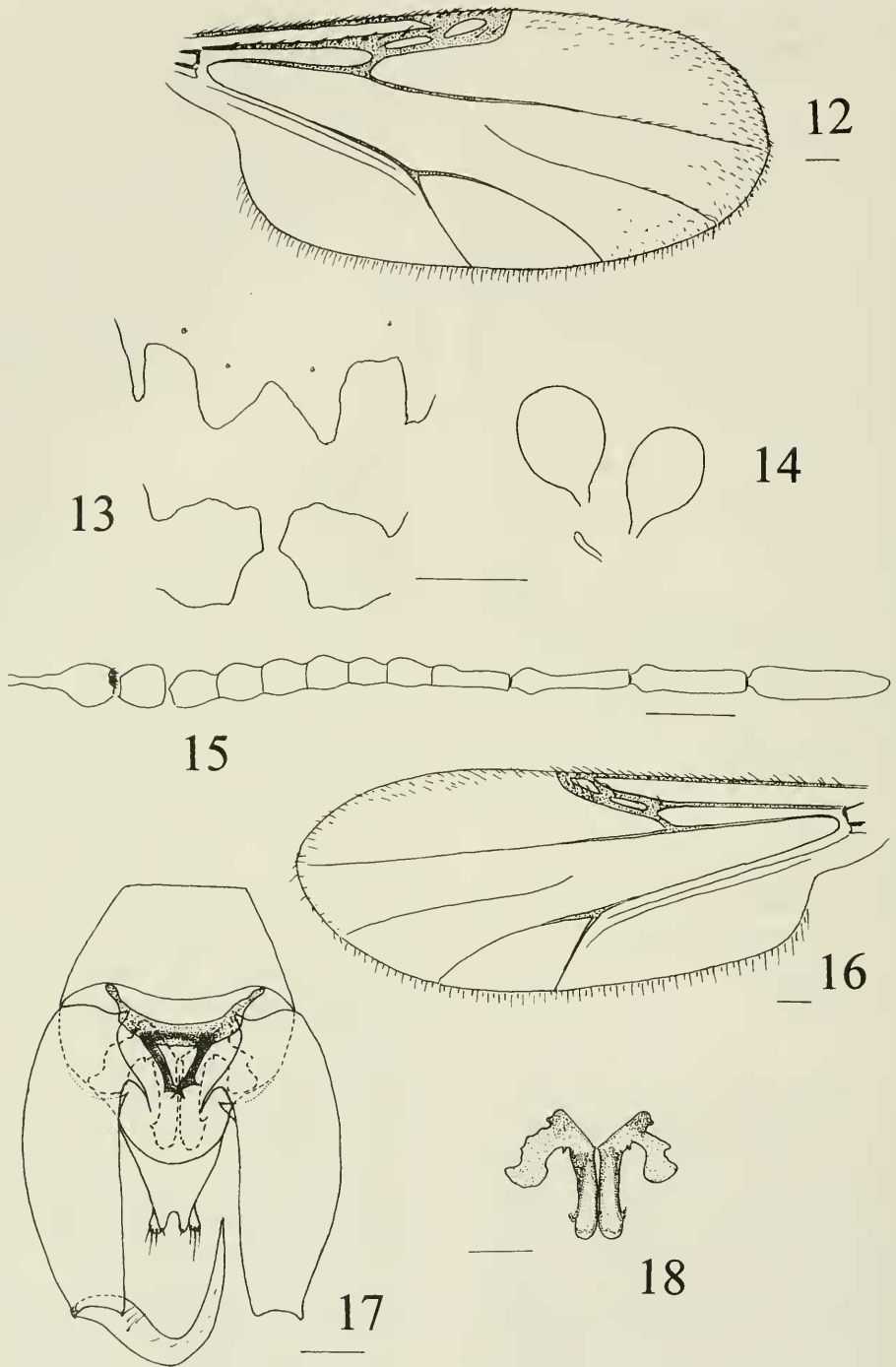
Abdomen: Dark brown, segments 7–9 heavily sclerotized. Genitalia as in Fig. 13. Distal portion of sternite 8 and most of sternite 9 covered with spiculate membrane; sternite 9 halves represented by two stout plates. Two ovoid spermathecae with moderately short necks, plus rudimentary 3rd (Fig. 14), measuring 0.056 by 0.038 mm, neck 0.010 mm, and 0.052 by 0.036 mm, neck 0.010 mm.

Holotype male.—Similar to female with the following notable sexual differences: Flagellum (Fig. 15) with flagellomeres 1–2 separated, 3–10 fused, 11–13 distinctly separated, lengths of flagellomeres 11–13 in μm 66-71-82; wing (Fig. 16) length 0.98 mm, breadth 0.38 mm, costal ratio 0.51. Genitalia as in Figs. 17–18. Sternite 9 twice as broad as long, caudal margin without excavations; tergite 9 short, rounded, apicolateral processes closely approximated near midline, with single subterminal seta; cercus short, with 3 apical setae. Gonocoxite elongate, 3 times longer than broad, mesobasal lobe very slender, sharply pointed, directed caudomesally; gonostylus slender with numerous small setae, distal half greatly curved (nearly 90°), tip sharply pointed. Aedeagus with stout, low basal arch extending $\frac{1}{3}$ of total length; distal portion represented by 2 heavily sclerotized pointed sclerites that cross mesally. Parameres (Fig. 18) separate, closely approximated distally; basal arms well developed, bilobate; distal portion stout, outer margin heavily sclerotized, tip bluntly rounded.

Distribution.—Southern Chile; known only from the type locality.

Types.—Holotype ♂, allotype ♀, Chile, Cautin, 1150 m, Conguillo Nat. Park. 4/5-II-1988, L. Masner (deposited in CNCI).

Etymology.—The specific name is a patronym in honor of the Chilean poet Pablo Neruda, who, in addition to his other monumental literary works, admirably de-



Figs. 12-18. *Borkenthelea nerudai*. 12, Female wing. 13, Sternites 8 and 9 of female. 14, Spermathecae. 15, Male flagellum. 16, Male wing. 17, Genitalia, parameres removed. 18, Parameres. Scales = 0.05 mm.

scribed the temperate forests of southern Chile in many of his books.

Discussion.—The female of this new species differs from all other species in the genus in lacking macrotrichia in cell cua_1 . The male of *B. harii* and *B. quatei* differ from this new species in having one or more caudomedian excavations on sternite 9. The male of *B. nothofagus* differs from this new species in having a gonocoxite with mesally directed mesal protuberance, a slightly curved gonostylus, parameres that are fused basally, and the distal portion of the aedeagus lacks pointed sclerites.

Borkenthelea nothofagus Spinelli and Grogan

Borkenthelea nothofagus Spinelli and Grogan 1993: 323 (♀, ♂; Argentina, Chile); Spinelli and Wirth 1993: 39 (Argentina; description; figs. ♂ and ♀); Borkent and Wirth 1997: 91 (in world catalog).

Diagnosis.—Distinguished from other species of *Borkenthelea* by the following combination of characters: female, large size (wing length 1.28–1.35 mm), clypeus with 2–3 pairs of setae, mandible with 9–10 teeth, hind claws massive, sternite 9 halves in the form of 2 stout plates, spermathecae necks short, wing with lumen of 2nd radial cell short and central portion of cell cua_1 with macrotrichia; males, tergite 9 tapering distally, sternite 9 without caudomedian excavations, gonostylus longer than gonocoxite, aedeagus triangular, strongly sclerotized with a low basal arch and blunt tip, and parameres fused, stout.

Distribution.—Argentina (west of Rio Negro province); Chile (Valdivia).

Remarks.—Spinelli and Grogan (1993) gave the range of female wing lengths for this species as 1.00–1.35 mm. However, this lowest value was for one paratype from Cautin, Chile. Therefore, because this specimen is herein recognized as belonging to *B. nerudai*, the actual range of female wing lengths for *B. nothofagus* based upon available specimens is 1.28–1.35 mm.

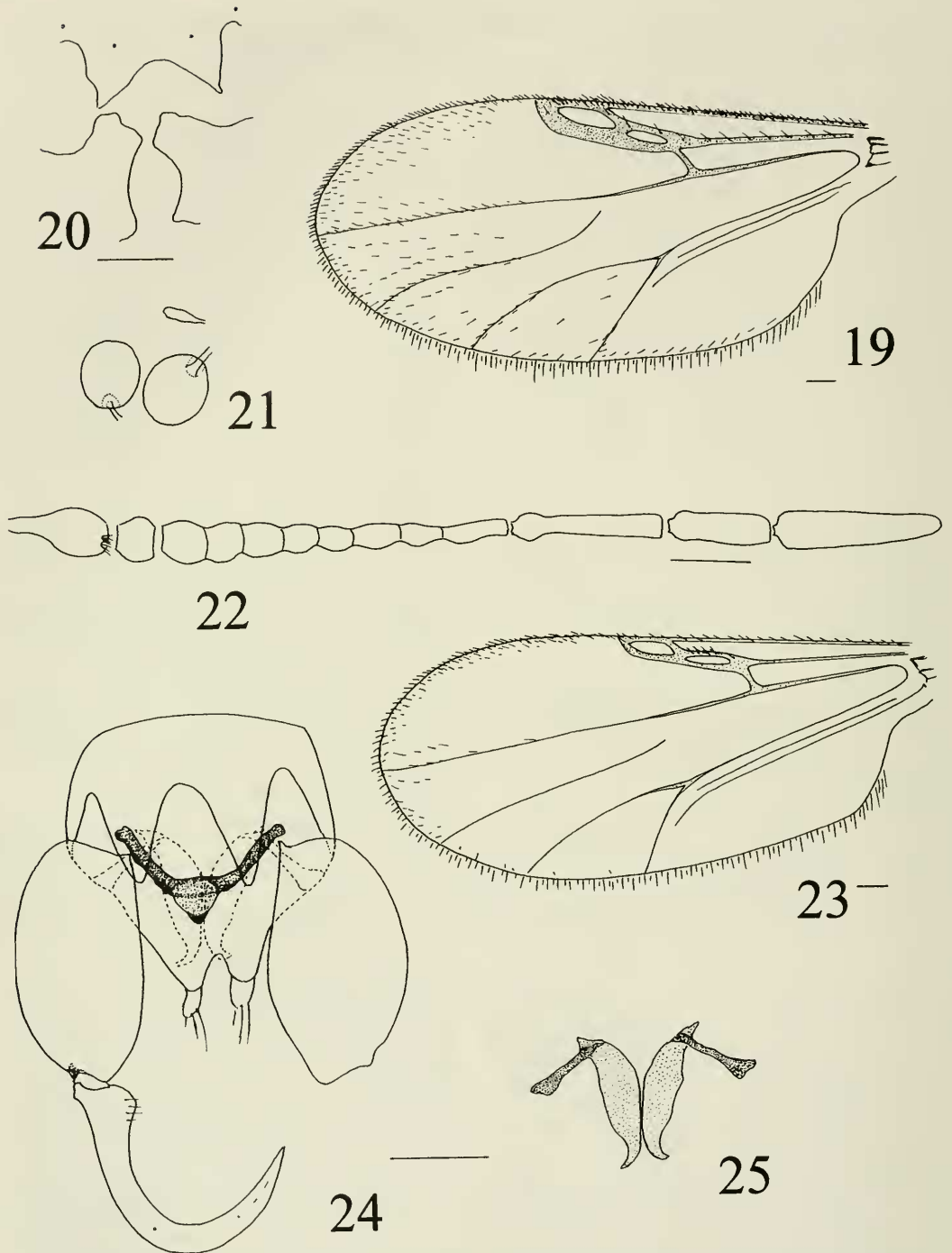
Borkenthelea quatei Spinelli and Grogan, new species
(Figs. 19–25)

Diagnosis.—Distinguished from other species of *Borkenthelea* by the following combination of characters: female, hind claws massive, mandible with 7 teeth, sternite 9 halves represented as 2 stout plates, spermathecae necks short, wing with lumen of 2nd radial cell elongated and central portion of cell cua_1 with macrotrichia; male, tergite 9 tapering distally, sternite 9 with 3 caudal excavations, gonostylus sickle-shaped; aedeagus heavily sclerotized with long basal arms and high basal arch, and parameres separate, stout.

Allotype female.—*Head*: Dark brown. Eyes pubescent, contiguous for a distance equal to diameter of 2 ommatidia. Antennal scape with 2 setae; flagellum brown; flagellomere 1 with 3 subapical sensilla coeloconica; lengths of flagellomeres in *um* 41-28-31-28-31-31-31-33-36-36-36-41-66; antennal ratio 0.82. Clypeus with one pair of setae. Palpus brown; lengths of segments in *um* 18-28-31-23-28; segment 4 with 2 setae. Mandible with 7 small teeth.

Thorax: Dark brown; prealar setae not visible; scutellum with 2 medial, 2 lateral setae. Wing (Fig. 19) membrane infuscated, veins brown; macrotrichia present in cells r_5 , m_1 , m_2 , cua_1 , only marginally in anal cell; radial cells well developed with broad lumen, 1st slightly longer than 2nd; radial veins thickened, especially posteriorly; media with long petiole, branching slightly distad to level of R_{2+3} , M_2 nearly contacting media, obsolete on extreme base; M_{3+4} and Cu_1 branching at level of midlength of 1st radial cell; wing length 1.12 mm, breadth 0.52 mm, costal ratio 0.59. Halter pale. Legs brown; hind tibial comb with 8 setae; hind tarsal ratio 2.00; tarsomeres 5 slender with moderately large, unequal sized claws without basal teeth, those of hind leg most massive, claw length proportions of fore, mid, hind legs 8:4, 7:5, 10:7.

Abdomen: Dark brown, segments 7–9



Figs. 19-25. *Borkenthelea quatei*. 19, Female wing. 20, Sternites 8 and 9 of female. 21, Spermathecae. 22, Male flagellum. 23, Male wing. 24, Male genitalia. 25, Parameres. Scales = 0.05 mm.

heavily sclerotized. Genitalia as in Fig. 20. Distal portion of sternite 8 and most of sternite 9 covered with spiculate membrane; sternite 9 halves represented by two stout plates. Two subequal sized ovoid spermathecae with slender offset necks plus rudimentary 3rd (Fig. 21), measuring 0.038 by 0.034 mm, neck 0.008 mm.

Holotype male.—Similar to female with the following notable sexual differences: Flagellum (Fig. 22) with flagellomeres 1–2 separate, 3–10 fused, 11–13 distinctly separated, lengths of flagellomeres 11–13 in *um* 105–71–112; wing (Fig. 23) length 1.11 mm, breadth 0.48 mm, costal ratio 0.53. Genitalia as in Figs. 24–25. Sternite 9 with 3 deep caudomedian excavations; tergite 9 short, tapering distally, apicolateral processes blunt, each with a single, small seta; cercus elongated with 3 apical setae. Gonocoxite stout, twice as long as broad, without mesobasal lobe; gonostylus slender, greatly curved, sickle-shaped, surface with small setae especially near tip. Aedeagus heavily sclerotized; main portion small, triangular, basal arch extending $\frac{1}{2}$ of total length, tip pointed; basal arms very long, straight. Parameres (Fig. 25) separate, heavily sclerotized; each half with main portion stout, tips slightly curved outwards; basal apodemes slender on proximal $\frac{1}{3}$, broadening distally, tip obliquely truncated.

Distribution.—Southwestern Argentina; known only from the type locality.

Types.—Holotype ♂, allotype ♀, Argentina, Chubut, P. N. Los Alerces, 9/12–XII–1994, L. Quate, Malaise trap (deposited in MLPA).

Etymology.—The specific name is a patronym in honor of Dr. Larry Quate, Research Associate at the Natural History Museum of Los Angeles County, who collected most of the specimens described in this paper during our 1994 trip to Patagonia.

Discussion.—Females of all other species in the genus differ from the female of this new species in having a mandible with 8–10 teeth. The female of *B. harii* is further distinguished from the female of this new

species in having non-massive hind claws, a pale halter, sternite 9 represented by two conspicuous plates, and spermathecae with short necks. The female of *B. nerudai* is further distinguished from the female of this new species in lacking macrotrichia in cell cua_1 . The female of *B. nothofagus* is further distinguished from the female of this new species in being larger (wing length 1.28–1.35 mm), having a clypeus with 2–3 pairs of setae, a larger antennal ratio (0.88–0.90), and the lumen of the 2nd radial cell is short and triangular.

Males of *B. nothofagus* and *B. nerudai* differ from the male of this new species in lacking caudomedian excavations on sternite 9. The male of *B. harii* differ from the male of this new species in having sternite 9 with only a single caudomedian excavation, a gonocoxite with a mesal truncated protuberance, a gonostylus clearly shorter than gonocoxite, and the distal portion of the aedeagus has two pairs of lateral teeth and a bifid tip.

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